

# Exploring Group Cognition as a Basis for Supporting Group Knowledge Creation and Sharing

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## Abstract

Within many domains, complexity encompasses many nuances of ill-definition, fluidity, organizational variation, uncertainty, conflicting constraints, and multiple solutions. Responses to these areas of complexity necessitate the social construction of knowledge among various multidisciplinary team members. Group Cognition is offered as the basis of all cognition and is explained as a combination of Distributed and Coordinated Cognition that directly affects the creation/recreation of distributed and similar knowledges within a team.

## Introduction

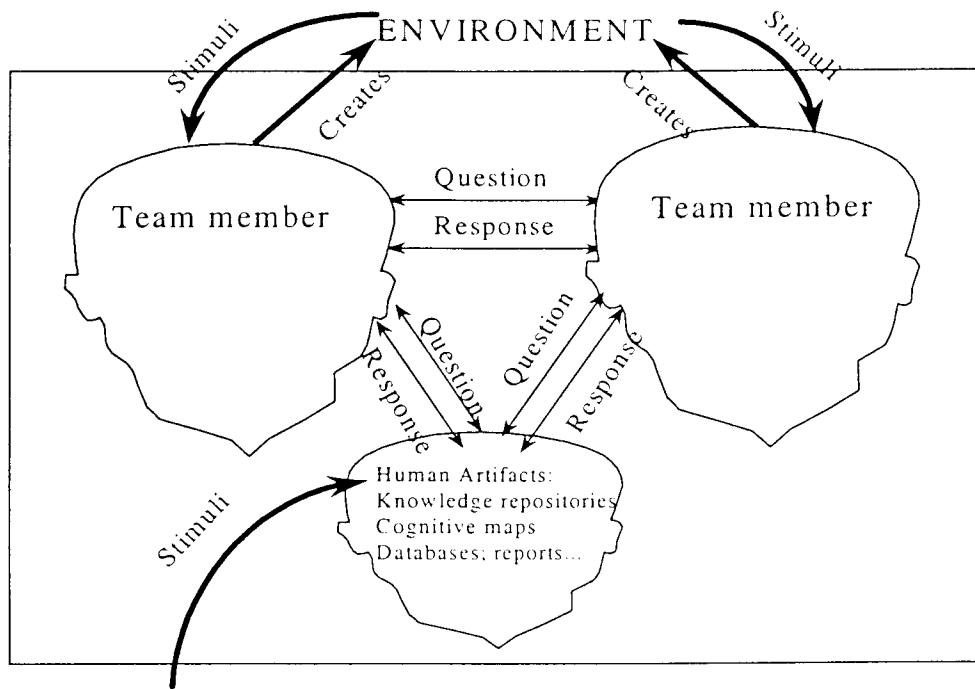
Within many domains, complexity encompasses many nuances of ill-definition, fluidity, organizational variation, uncertainty, conflicting constraints, and multiple solutions. Responses to these areas of complexity necessitate the social construction of knowledge among various multidisciplinary team members. The process by which interpretation, meaning, decisions, and actions transpire is referred to as *group sensemaking*. This process is especially salient for understanding how to achieve a group-centered approach in the design of multi-person/team interfaces. Many of the current information technologies have not been designed from a group-centered approach which limit their usefulness.

## Foundations

Sensemaking is "the process whereby people interpret their world to produce the sense that shared meanings exist [Leiter in Gephart, 1993, pp. 1469-1470]." Social actors actively engage in sensemaking by interpreting the social world through conversation and textual accounts, explanations offered and accepted, and ongoing discourses that describe and make sense of the social world [Gephart, 1993, Weick, 1979]. Sensemaking occurs and can be studied in the discourses of social members – the intersubjective social world – rather than simply occurring in their minds. Further, the socially constructed object, or facts, of the world exist through and are located in the discursive sensemaking of members [Gephart, 1993, 1470]."

In complex environments, where not all variables and relationships are known, humans create rather than discover their future [See Figure 1]. They create the future by accepting stimuli from their environment, including others around them, and interpreting what these stimuli mean. The subsequent actions, including probing of the environment, leads to additional stimuli that must provide meaningful affordances to grab attention, and subsequent processing. Human and non-human agents must be attuned to relevant affordances, to interpret them, to act based on them, and to probe for additional stimuli.

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**Figure 1**  
**Group Sensemaking in Ill-defined**

**Situations**

### 2.1. Boundary Objects

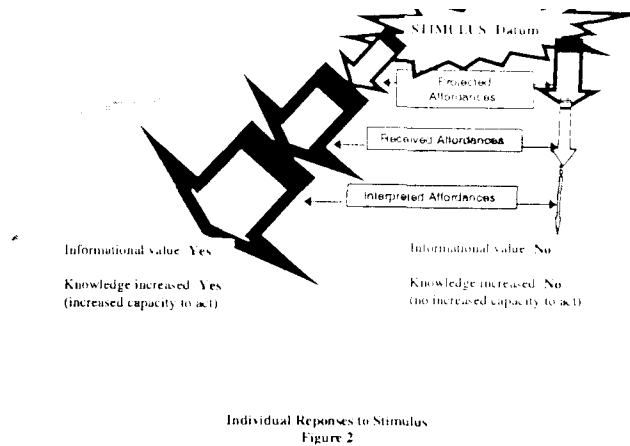
With greater shared context (shared beliefs, expectations, perceptions...) intent is casually communicated. Perspective Taking occurs through boundary objects [Boland and Tenkasi, 1995]. Boundary objects are "anything perceptible by one or more of the senses [American Heritage Dictionary, 1980]," i.e., anything that can be observed consciously or subconsciously. Ethnographers view sensemaking dialogs as a way to externalize thoughts and achieve a shared construction of meaning. These dialogs may be considered boundary objects that permit exchange of thoughts. Mapping techniques, and any stored artifacts are boundary objects. Non-verbal expressions can also be classified as boundary objects. These include such things as "body language," tone of voice, raised heartbeats, head movement, eye movement, gestures, brain patterns, etc. Boundary objects can be used to identify convergence and divergence related to a given situation.

### 2.2. Data, Information, Knowledge, Intelligence, and Cognition

Knowledge sharing is creating new potential/capacities for action [Churchman, 1971]. There is no difference in the physical nature of data and information. Informational value is relative to the capacity of an actor, human or non-human. The actor possesses the capacity to interpret the data so they have informational value for the actor. When data are interpreted as having informational value, they are labeled as information. As noted above, knowledge is the capacity to act, which includes conceptualizing. Therefore new knowledge is the increased capacity to act. Cognition is the process where capacities to act manifest themselves. Given a certain intelligence (capacity to acquire and apply knowledge), cognition is the mental process by which capacities to act are acquired and created.

### 2.3. Group Cognition and Group Knowledge

Over the last several years, my view of cognition has changed from one where all cognition is individual to where all cognition is group cognition. When I speak of all cognition being group cognition, it is a subset of the ideas of Winograd and Flores [1987] who state that all cognition is social and emphasize the role of language and society in one's thinking. At the most elemental level, individuals use words within their own minds and with others to think about something. This reflects the views of several researchers who emphasize that language strongly and directly affects thought. Language is a social artifact created and employed by a community of actors.



Individual Responses to Stimulus  
Figure 2

To distinguish from these broad ideas that all cognition is social, Group Cognition deals with the actual thoughts that are generated within one's mind. What we think depends upon one's interactions with the world, a world of other actors and actor-created artifacts. It is the boundary objects (anything observable) as initial stimuli, and the reflection on these objects, that stimulate the generation of thoughts, the cognition process. It is the cognition process that recreates the knowledge (the capacity to act) available in a situation. Therefore, "what one thinks" is dependent on these boundary objects that originate with actors, both human and non-human. Knowledge that has not been previously externalized and recorded, only exists at the moment of activation/recreation (tacit and explicit), i.e., tacit knowledge is a capacity to act that is activated, only one is not aware of it. Explicit knowledge is knowledge that is activated, and the actor is aware of it. One can externalize both tacit knowledge and explicit knowledge – tacit knowledge emerges as observable capacity to act as a by-product of actions/behaviors, including open reflection of these actions/behaviors.

Figure 2, presents a diagram of different interpretation processes by two actors. Ecologists argue that objects "afford" their meaning, for example, a doorknob "affords" "graspness," while constructionists argue that actors "construct" meanings [Preece et al, 1995]. Figure 2 incorporates these ideas in describing individual responses to stimuli. A more detailed discussion of the ecological and constructionist viewpoints can be found in Nosek [1998].

A stimulus projects a certain value of what it is, the projected affordance, the first arrow that emerges from the stimulus. Actors, with their own set of characteristics, subconsciously filter the projected affordances into received affordances, the second arrow emerging from the first arrow. For example, a doorknob projects the same graspness, however if the actor were blind, the received affordance would be different and this received affordance is separate from the constructed meaning of the object. Actors interpret the received affordances and create an "interpreted affordance", the third arrow emerging from the second arrow. The actor on the left interprets the

received affordance, the interpreted affordance, as important, indicated by the larger arrow. This datum is interpreted as providing informational value, and this actor's knowledge, the capacity to act, increases. One could say, this actor has greater knowledge of the situation. The actor on the right interprets the received affordance, the interpreted affordance, as not important, indicated by the diminished arrow. This datum is interpreted as providing no informational value, and this actor's knowledge, the capacity to act, does not increase. One could say there are two "knowledges" of the same situation [Edamala, 1997], i.e., the actor on the left has increased his/her/its knowledge of the situation, and this knowledge of the situation is different from the knowledge that the actor on the right possesses.

The skills, background, motivations... of actors affect interpreted affordance. People may selectively filter projected affordances and construct different meanings while converging on a similar way to act. Externally viewed, the convergence to act in a similar way may falsely indicate similar capacities to act (knowledge), or similar mental models, however, multiple knowledges or mental models are likely to exist. For example, two people cast a vote for someone, but their mental models could be different, even inconsistent [Shaw and Gaines, 1994] with each other, however they act in the same way, casting the same vote. This relates to how much mental models need to be shared or how similar the knowledges of the situation must be to act in a similar, coordinated way. Shaw & Gaines [1994] emphasize the importance of coordination over consistency in team action.

The more important the action, the more dynamic, equivocal the task, the more unreliable the data, the more important group sensemaking to the emergence of knowledges in this situation, the emergence of the capacities to act, sufficiently coordinated to engender effective action. In these cases, knowledges are likely different, but the emergence of sufficient capacities to act in a coordinated fashion is critically dependent on the social construction of these knowledges.

How do we coordinate cognition within a group to create reasonable knowledges of the situation? What boundary objects are needed and when and how do they need to be employed to create the knowledges of the situation to ensure effective action? Within a group there is a need for distributed knowledge and distributed cognition that are affected by boundary objects available to actors who receive projected affordances and interpret these affordances differently, tacitly and explicitly. There are also times when more coordinated cognitive processing among group members is needed to create similar knowledges of the situation.

### 3. Concluding Remarks

This paper explores Group Cognition as a basis for supporting Group Knowledge Creation and Sharing. It attempts to synthesize multiple literatures to offer novel ways of viewing Group Knowledge Creation and Sharing and generate discussion on how information systems can support this process. Based on the breadth of the topic, this report must be considered a work-in-progress, a snapshot of the exploration of such a complex subject. As a work-in-progress there has been no attempt to eliminate questions or problems that emerge in such an exploration to make the package tidy with no loose ends. To the contrary, we openly identify loose ends, pull them, and encourage readers to pull them, tuck them in, or cut them off if possible.

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